Personality and Illness Adaptation in Adults With Type 1 Diabetes: The Intervening Role of Illness Coping and Perceptions

Jessica Rassart, Koen Luyckx, Theo A. Klimstra, Philip Moons, Chris Groven, & Ilse Weets

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Jessica Rassart
School Psychology and Child and Adolescent Health, Faculty of Psychology, KU Leuven, Leuven, Belgium

Prof. Dr. Koen Luyckx
School Psychology and Child and Adolescent Health, Faculty of Psychology, KU Leuven, Leuven, Belgium

Dr. Theo A. Klimstra
Developmental Psychology, School of Social and Behavioral Sciences, Tilburg University, Tilburg, The Netherlands

Prof. Dr. Philip Moons
Centre for Health Services and Nursing Research, Department of Public Health, KU Leuven, Leuven, Belgium; Division of Congenital and Structural Cardiology, University Hospitals Leuven, Leuven, Belgium; The Heart Centre, Copenhagen University Hospital, Copenhagen, Denmark

Chris Groven & Prof. Dr. Ilse Weets
Diabetes Research Center, Free University Brussels, Brussels, Belgium

Address for Correspondence:
Jessica Rassart
Tiensestraat 102, bus 3717
3000 Leuven (Belgium)
Email: Jessica.Rassart@ppw.kuleuven.be

ABSTRACT

Inspired by the common sense model, the present cross-sectional study examined illness perceptions and coping as intervening mechanisms in the relationship between Big Five personality traits and illness adaptation in adults with Type 1 diabetes. A total of 368 individuals with Type 1 diabetes (18-35 years old) completed questionnaires on personality, diabetes-related problems, illness perceptions, and illness coping. First, Neuroticism, Agreeableness, and Conscientiousness predicted patients' illness adaptation, above and beyond the effects of sex, age, and illness duration. Second, illness coping was found to be an important mediating mechanism in the relationship between the Big Five and illness adaptation. Finally, perceived consequences and perceived personal control partially mediated the relationship between the Big Five and illness coping. These findings underscore the importance of examining patients' personality to shed light on their daily functioning and, hence, call for tailored intervention programs which take into account the personality of the individual patient.

Keywords: Diabetes; Big Five; Personality; Illness perceptions; Illness Coping.

INTRODUCTION

Type 1 diabetes is the most common metabolic condition in Western countries. Once diagnosed, patients begin a life-long treatment regimen, including daily dietary restrictions and insulin administrations (Schneider et al., 2007). Especially for young people on the verge of adulthood, the presence of a chronic illness such as diabetes can be considered particularly stressful. Indeed, the challenges and responsibilities accompanying chronic illness might interfere with the many developmental tasks at hand, such as forming an adult identity and settling into a life of their own (Arnett, 2000; Luyckx, Schwartz, Goossens, Beyers, & Missotten, 2011). Although a substantial proportion of young patients with Type 1 diabetes tends to show signs of resilience (Pacaud et al., 2007; Seiffge-Krenke, 2001), some patients have more difficulty adapting to their illness (Gendelman et al., 2009). Poor illness adaptation has been found to lead to substantial morbidity and even mortality among patients with diabetes (Sullivan et al., 2012; Weissberg-Benchel, Wolpert, & Anderson, 2007). Hence, more research on the determinants of poor illness adaptation is needed to assist clinicians in identifying patients at risk. One potentially important determinant that has not received much attention in the diabetes literature is personality (Rassart, et al., 2013; Van de Ven & Engels, 2011). In the present study, we examined the link between personality and illness adaptation in adults with Type 1 diabetes and explored the intervening role of illness coping and illness perceptions.

Personality Traits and Illness Adaptation

Throughout the last three decades, there has been a growing consensus on the higher-order structure of personality, as a majority of researchers now agree that personality can be subsumed under five broad traits (Caspi, Roberts, & Shiner, 2005). These traits are Extraversion (energy, sociability, and experiencing frequent positive moods), Agreeableness (kindness, empathy, and cooperativeness), Conscientiousness (organizational and motivational aspects of

behavior), Neuroticism (the inability to deal with negative emotions), and Openness to Experience (the way an individual seeks and deals with new information).

According to the five-factor theory of personality (McCrae & Costa, 1999), these five broad traits or basic dispositions affect the ways in which people adapt to the world. More specifically, these basic dispositions are assumed to shape people's thoughts, feelings, and actions, and how they cope with the challenges they are confronted with. In individuals with chronic illness (i.e., asthma, cancer, and congenital heart disease), Big Five personality traits were found to relate to several indicators of illness adaptation such as quality of life and perceived physical and psychological health (De Clercq, De Fruyt, Koot, & Benoit, 2004; Rassart et al., 2013; Van De Ven & Engels, 2011). Indeed, whereas certain personality traits may help patients in dealing with various stressors, other personality traits may put patients at risk for poor illness adaptation. Unfortunately, research on the relationship between personality and illness adaptation in individuals with Type 1 diabetes is rather scarce and has important limitations.

First, previous research mainly focused on the influence of isolated personality traits such as Neuroticism or Conscientiousness on patients' illness adaptation (e.g., Brickman, Yount, Blaney, Rothberg, & De-Nour, 1996; Skinner, Hampson, & Fife-Shaw, 2002). Recent studies in other clinical populations, however, have shown that all Big Five personality traits (with the exception of Openness) can be considered important predictors of illness adaptation (Rassart et al., 2013; Van De Ven & Engels, 2011).

Second, previous research mainly focused on the influence of patients' personality traits on health behavior (e.g., Skinner et al., 2002) and objective indicators of illness adaptation such as metabolic control and renal deterioration (e.g., Brickman et al., 1996; Hepburn, Langan, Deary, Macleod, & Frier, 1994; Vollrath, Landolt, Gnehm, Laimbacher, & Sennhauser, 2007). As diabetes and its treatment impose multiple demands on patients, studies examining the

relationship between personality and subjective indicators of illness adaptation such as emotional and social difficulties are needed as well (Lawson, Bundy, Belcher, & Harvey, 2010; Taylor, Frier, Gold, & Deary, 2003).

Third, less is known about the mechanisms through which personality influences illness adaptation in individuals with Type 1 diabetes. Previous research in this population has shown personality to be related to both illness perceptions and coping (e.g., Lawson et al., 2010), which, in turn, have been associated with both objective and subjective indicators of illness adaptation (e.g., Edgar & Skinner, 2003; Hagger & Orbell, 2003; Luyckx, Vanhalst, Seiffge-Krenke, & Weets, 2010). However, no study to date has examined illness perceptions and coping as mediators in the relationship between personality and illness adaptation using an integrative framework.

The Intervening Role of Illness Perceptions and Coping

A model that is increasingly being used to understand the ways in which patients handle their illness is Leventhal's common sense model (CSM; Leventhal, Nerenz, & Steele, 1984). This model assumes that, in order to make sense of their illness, patients create their own representations of the illness which, in turn, influence their coping strategies and illness adaptation (Hagger & Orbell, 2003). The present study focused on two such illness perceptions: perceived personal control (i.e., ideas about whether the illness can be cured and/or personally controlled through the use of coping behaviors; Hagger & Orbell, 2003) and perceived consequences (i.e., ideas about the seriousness of the illness in terms of physical, emotional, and social consequences; Hagger & Orbell, 2003). Both of these illness perceptions have been proven important predictors of illness adaptation (Edgar & Skinner, 2003; Hagger & Orbell, 2003).

With respect to coping, we focused on illness-specific coping strategies, as several authors emphasized that coping responses depend heavily on the particular situation and the

particular characteristics of the problem at hand (Hagger & Orbel, 2003; Seiffge-Krenke, Aunola, & Nurmi, 2009). Previous research has highlighted the competence that many young people with diabetes display in coping with their illness (Seiffge-Krenke, 2001). Two such optimal coping strategies are "tackling spirit" (i.e., taking on an active role in managing one's illness with an optimistic attitude) and illness integration (i.e., accepting and integrating the illness as part of the self). These coping strategies have been found to be positively related to patients' illness adaptation (Luyckx et al., 2010). Some patients, however, do not actively cope with diabetes, but rather regress to a state of avoidance (i.e., distracting themselves and directing their attention away from important responsibilities of illness management) or passive resignation (i.e., perceiving themselves as helpless in dealing with the daily treatment regimen and the many challenges their illness poses). Such difficulties in coping are often related to poorer illness adaptation (Luyckx et al., 2010).

Integrating the Five-Factor Theory of Personality and the Common Sense Model

Although previous research has demonstrated the importance of personality, illness perceptions, and coping strategies for patients' illness adaptation, an integrative model linking these different constructs is largely lacking. However, such a model could guide health care professionals in designing and refining intervention programs aimed at improving patients' illness adaptation. A first attempt to take such an integrative approach is the study by Lawson and colleagues (2010). In their study, illness perceptions were found to partially mediate the relationships between Big Five personality traits and generic coping in adults with Type 1 and Type 2 diabetes. More specifically, patients low in Conscientiousness and high in Neuroticism were found to report more consequences of their illness, whereas patients high in Extraversion and Openness were found to report more personal control. High personal control and low perceived consequences, in turn, were related to more adaptive coping strategies such as planning, positive reinterpretation, and seeking emotional support. Although the study by

Lawson and colleagues (2010) provided important insights, it remains unclear how illness adaptation fits into the model proposed. Furthermore, the study did not look at how patients coped with their diabetes, despite the fact that previous research has emphasized the need to include illness-specific measures of coping (Hagger & Orbel, 2003). Finally, only adaptive coping was taken into account, at the cost of looking at more maladaptive strategies such as withdrawal.

The Present Study

The present study was guided by three main research objectives (summarized in Figure 1). First, as shown in Figure 1 Panel a, we investigated whether Big Five personality traits could predict patients' illness adaptation above and beyond the effects of sex, age, and illness duration. Building on the findings from previous research (Rassart et al., 2013; Van de Ven & Engels, 2012), we expected higher levels of Extraversion, Agreeableness, and Conscientiousness to predict fewer diabetes-related problems. In contrast, higher levels of Neuroticism were expected to predict relatively more diabetes-related problems.

Second, as shown in Figure 1 Panel b, we examined whether illness coping functioned as an important intervening mechanism in the relationship between the Big Five and illness adaptation. We hypothesized that illness coping would partially mediate this relationship. More specifically, patients high in Extraversion, Conscientiousness and Agreeableness, and low in Neuroticism were expected to use more tackling spirit and diabetes integration, and less avoidant coping and passive resignation (Lawson et al., 2010; Van de Ven & Engels, 2011). Tackling spirit and diabetes integration, in turn, were expected to relate positively to patients' illness adaptation. In contrast, avoidant coping and passive resignation were expected to relate negatively to patients' illness adaptation (Luyckx et al., 2010).

Third, as shown in Figure 1 Panel c, we examined whether illness perceptions functioned as important intervening mechanisms in the relationship between Big Five personality traits and

illness coping. Building on the findings from previous research (Lawson et al., 2010), we expected illness perceptions to partially mediate these relationships. That is, patients low in Conscientiousness and high in Neuroticism were expected to report more consequences of their illness, whereas patients high in Extraversion and Openness were expected to report more personal control (Lawson et al., 2010). However, based on theoretical grounds, we expected other associations to emerge as well. For instance, extraverted patients have been found to invest more strongly in social relationships and activities despite their illness, and thus can be expected to perceive fewer (social) consequences (Van de Ven & Engels, 2011). In addition, agreeable patients tend to hold a positive, optimistic outlook on life, using more positive reinterpretation when dealing with their illness. Hence, they might also report fewer consequences and higher perceived control (Van de Ven & Engels, 2011). Finally, we hypothesized that patients reporting less consequences and more personal control would use more tackling spirit and diabetes integration, and less avoidant coping and passive resignation (Hagger & Orbell, 2003; Lawson et al., 2010).

METHOD

Participants and Procedure

Patients were recruited from the Belgian Diabetes Registry (Vandewalle et al., 1997). They were eligible for inclusion if they met the following criteria: Dutch speaking, presence of Type 1 diabetes, age 18-35 years, the availability of contact details, minimum two follow-up blood samples during the last five years, and not involved in one of our previous studies. In April 2012, the database included 8,957 patients, of which 808 patients met the inclusion criteria. All eligible patients were sent a questionnaire, information letter, informed consent form, and pre-stamped return envelope by surface mail. A total of 368 patients (164 women) returned completed questionnaires (46% participation rate). Mean age was 24.12 years (*SD* = 5.60). A total of 45% were in college, 48% were employed full- or part-time, and 7% were

unemployed. The majority of patients (65%) had no partner or were still living with their parents. Of the remaining patients, 5% were in a romantic relationship, 16% were living together with their partner, and 14% were married. Average illness duration was 9.41 years (*SD* = 5.75), with the mean age at diagnosis being 14.70 years (*SD* = 7.67). A total of 14% of the sample used an insulin pump for their daily diabetes regimen; the remaining participants injected themselves with insulin. This study was approved by the Institutional Review Board at the KU Leuven and, following a detailed written briefing, all participants signed an informed consent form.

Measures

Personality traits. Personality traits were measured using the Quick Big Five (Vermulst & Gerris, 2005). Participants rated themselves on 30 adjectives using a 7-point Likert scale, ranging from 1 (*completely untrue*) to 7 (*completely true*). Each personality trait was assessed with six items, such as "withdrawn" and "quiet" (Extraversion, inverse coded), "efficient" and "organized" (Conscientiousness), "sympathetic" and "helpful" (Agreeableness), "nervous" and "concerned" (Neuroticism), and "creative" and "investigative" (Openness). Cronbach's alphas ranged between .77 and .92.

Illness coping. The revised Diabetes Coping Measure (Keers et al., 2006; Welch, 1994) was used to assess four different ways of coping with diabetes, that is, tackling spirit, avoidant coping, passive resignation, and diabetes integration. For tackling spirit (5 items), sample items include: "Because of my own experience, I can help educate other people about diabetes" and "Most people would be a lot healthier if they followed a diabetic diet". For avoidant coping (5 items), sample items include: "I dislike reading about diabetes because it only makes me worry more" and "I am reluctant to visit my doctor for my regular diabetes check-up when I know I am in poor blood glucose control". For passive resignation (5 items), sample items include: "There is little I can do to control my blood glucose well" and "Whatever I do, diabetes

complications will continue to ruin my health". For diabetes integration (6 items), sample items include: "Diabetes is the worst thing that ever happened to me" and "Diabetes makes me feel different from everyone else" (both inverse coded). Cronbach's alphas for tackling spirit, avoidant coping, passive resignation, and diabetes integration were .35, .65, .74, and .68, respectively. Because of the low internal consistency of tackling spirit, we excluded this scale from all analyses.

Illness perceptions. Perceived consequences and personal control were measured with the respective subscales from the revised Illness Perception Questionnaire (Moss-Morris et al., 2002). For perceived consequences (6 items), sample items include: "My diabetes has major consequences on my life" and "My diabetes is a serious condition". For perceived control (6 items), sample items include: "There is a lot I can do to control my symptoms" and "The course of my diabetes depends on me" (perceived personal control; 6 items). Cronbach's alphas were .69 and .76 for perceived consequences and personal control, respectively.

Illness adaptation. To assess patients' illness adaptation, we used the Problem Areas in Diabetes Scale (Polonsky et al., 1995) which measures diabetes-related treatment, food, emotional, and social support problems. Sample items are: "Feeling discouraged with your diabetes regimen (treatment; 3 items), "Feelings of deprivation regarding food and meals" (food; 3 items), "Feeling alone with diabetes" (social support; 2 items), and "Feeling scared when you think about living with diabetes" and "Feeling constantly burned out by the constant effort to manage diabetes" (emotional; 12 items). The total score was calculated as the average of the individual item responses and was transformed to a 0–100 scale (van Bastelaar et al., 2010). Higher scores indicate more diabetes-related problems and, thus, poorer illness adaptation. Cronbach's alpha for the total scale was .94.

Statistical Analysis

To investigate our three research hypotheses, we conducted structural equation modeling (SEM) in Mplus 4.0 (Muthén & Muthén, 2002). Using SEM, several models representing the hypothesized relationships among the Big Five, illness perceptions, illness coping, and illness adaptation were tested by evaluating how well these models fitted the data (Kline, 2005). For all analyses, the BOOTSTRAP option available in Mplus was used, with a total of 5,000 resamples. Bootstrapping is a method that involves repeatedly sampling from the dataset and estimating the indirect effect in each resampled dataset. By repeating this process numerous times, bootstrapping enables researchers to obtain more stable and accurate parameter estimates as well as confidence intervals for each indirect effect (Preacher & Hayes, 2008).

For Research Objective 1 (i.e., the predictive value of the Big Five for illness adaptation as displayed in Figure 1 Panel a), a model including paths from all Big Five personality traits to illness adaptation was tested (Model 1). For Research Objective 2 (i.e., the intervening role of illness coping between Big Five and illness adaptation as displayed in Figure 1 Panel b), the following three models were compared (Holmbeck, 1997): (a) a direct effects model which included direct effects from the Big Five to illness adaptation only (being Model 1 discussed above); (b) a full mediation model in which the Big Five was indirectly related to illness adaptation through illness coping (Model 2); and (c) a partial mediation model, including both direct and indirect paths (through illness coping) from the Big Five to illness adaptation (Model 3). Similarly, for Research Objective 3 (i.e., the intervening role of illness perceptions between Big Five and illness coping as displayed in Figure 1 Panel c), the following three models were compared: (a) a direct effects model which included direct effects from the Big Five to illness coping (being Model 3 discussed above); (b) a full mediation model, in which the Big Five was indirectly related to illness coping through illness perceptions (Model 4); and (c) a partial mediation model, including both direct and indirect paths (through illness perceptions) from the Big Five to illness coping (Model 5).

Statistical controls (i.e., sex, age, and illness duration) were included by estimating paths from these variables to each of the constructs in all models tested. To evaluate model fit, we used the chi-squared index, which should be as small as possible; the Root Mean Square Error of Approximation (RMSEA), which should be less than .08 (< .05 is excellent); and the Comparative Fit Index (CFI), which should exceed .90 (> .95 is excellent) (Hu & Bentler, 1999).

RESULTS

Preliminary Mean-Level and Correlational Analyses

A multivariate analysis of variance (MANOVA) was conducted to investigate whether sex was related to the study variables. Based upon Wilks' Lambda, statistically significant multivariate sex differences were found, F (11,353) = 5.76, $p < .001$, $\eta^2 = .15$. As shown in Table 1, follow-up univariate analyses indicated that women scored higher than men on Conscientiousness and Neuroticism, whereas men scored higher on Openness. Furthermore, women reported poorer illness adaptation, lower perceived personal control, and higher use of passive resignation as compared to men.

Correlations are presented in Table 2. This table reveals that Extraversion and Agreeableness were positively related to perceived personal control and diabetes integration, and negatively related to perceived consequences and passive resignation. In addition, Agreeableness was negatively related to avoidant coping and diabetes-related problems. Neuroticism was positively associated with perceived consequences, avoidant coping, passive resignation, and diabetes-related problems and negatively associated with perceived personal control and diabetes integration. Conscientiousness was negatively related to avoidant coping and passive resignation. Openness was positively related to perceived personal control and diabetes integration, and negatively related to perceived consequences and diabetes-related problems. Finally, age was positively associated with Conscientiousness and Openness and

negatively associated with avoidant coping. Illness duration was positively related to passive resignation and avoidant coping.

Research Objective 1: Associations Between the Big Five and Illness Adaptation

Associations between the Big Five personality traits and illness adaptation were tested in Model 1. This model included all possible paths from the Big Five to illness adaptation. Therefore, Model 1 was fully saturated, which means that no model fit statistics could be calculated. Figure 2 graphically depicts all significant and non-significant paths linking the Big Five to illness adaptation. As can be seen in this figure, Agreeableness and Conscientiousness negatively predicted diabetes-related problems, whereas Neuroticism positively predicted diabetes-related problems. No significant associations emerged between Extraversion, Openness, and diabetes-related problems. Hence, these findings partially support the hypothesis displayed in Figure 1 Panel a, in that some Big Five personality traits uniquely predicted patients' illness adaptation.

Research Objective 2: The Intervening Role of Illness Coping

To investigate the extent to which coping mediated the associations between the Big Five and illness adaptation, two additional models were compared. Model 2, in which the Big Five was indirectly related to illness adaptation through illness coping, fitted the data adequately, χ^2 (5) = 12.27, p = .031, CFI = .99, RMSEA = .06. However, this model fitted the data significantly less well as compared to Model 3, in which the Big Five was related to illness adaptation in both a direct and indirect manner (i.e., through illness coping), $\Delta\chi^2$ (5) = 12.27, p = .031. Hence, Model 3 was retained for further analyses. Figure 3 graphically depicts all significant direct and indirect paths between the Big Five and illness adaptation as obtained in Model 3. Non-significant paths of this model are not included in this figure for reasons of clarity, but are given in Table 3.

As can be seen in Figure 3, the direct paths from Agreeableness and Conscientiousness to diabetes-related problems were no longer significant and, consequently, were fully mediated by illness coping. In contrast, the direct path from Neuroticism to diabetes-related problems remained significant – but was substantially reduced – which is indicative of partial mediation through illness coping. With regard to the associations between the Big Five and illness coping, we found that Agreeableness positively predicted diabetes integration, but was unrelated to the use of avoidant coping and passive resignation. In contrast, Conscientiousness negatively predicted avoidant coping and passive resignation but was unrelated to the use of diabetes integration. Neuroticism positively predicted avoidant coping and passive resignation, and negatively predicted diabetes integration. Finally, Extraversion and Openness were unrelated to all three coping strategies. With regard to the associations between illness coping and illness adaptation, we found that diabetes-related problems were positively predicted by avoidant coping and passive resignation, whereas diabetes integration negatively predicted diabetes-related problems.

Table 5 provides an overview of each indirect path, its point estimate, standard error, and 95% confidence intervals. To illustrate how such indirect paths may be interpreted, consider the indirect path from Agreeableness to diabetes-related problems through diabetes integration. This path has a point estimate of -.072 which is significant at the .01-level. Furthermore, the confidence interval accompanying this indirect effect goes from -.139 to -.019. The finding that zero is not included in this interval again indicates that the indirect effect is significantly different from zero. As shown in Table 5, all indirect paths between these Big Five traits and illness adaptation through illness coping were significant. Hence, the hypothesis displayed in Figure 1 Panel b was partially supported, in that illness coping partially mediated the associations between Big Five traits and illness adaptation.

Research Objective 3: The Intervening Role of Illness perceptions

As discussed in the previous paragraph, Model 3, in which the Big Five was related to illness adaptation both directly and indirectly (through illness coping), fitted the data adequately. To investigate the extent to which illness perceptions mediated the associations between the Big Five and illness coping, two additional models were compared. Model 4, in which the Big Five was indirectly related to illness coping through illness perceptions, fitted the data adequately, χ^2 (17) = 61.79, $p < .001$, CFI = .96, RMSEA = .09. However, this model fitted the data significantly less well as compared to Model 5 in which the Big Five was related to illness coping in both a direct and indirect manner (i.e., through illness perceptions), $\Delta\chi^2$ (15) = 45.56, $p < .001$. Based on modification indices, one additional path from perceived consequences to diabetes-related problems was added to Model 5. This final model (Model 6) provided an excellent fit to the data, $\chi 2$ (1) = 1.48, p = .22, CFI = .99, RMSEA = .04, and, hence, was retained for further analyses. Figure 4 graphically depicts all significant direct and indirect paths between the Big Five and illness coping. Non-significant paths are not included in this figure due to reasons of clarity, but are given in Table 4.

As can be seen in Figure 4, the path from Agreeableness to diabetes integration turned non-significant and, hence, was fully mediated by patients' illness perceptions. All other paths from the Big Five to illness coping – identified in Model 3 – remained significant. Patients' illness perceptions partially mediated the paths from Neuroticism to avoidant coping, passive resignation, and diabetes integration. With regard to the associations between the Big Five and illness perceptions, we found that patients' perceptions of consequences were positively predicted by Neuroticism, and negatively predicted by Agreeableness. No associations emerged between perceived consequences and Extraversion, Conscientiousness, or Openness. Perceived personal control was negatively predicted by Neuroticism but was unrelated to Extraversion, Agreeableness, Conscientiousness, and Openness. With regard to the associations between illness perceptions and illness coping, we found that avoidant coping and passive resignation

were positively predicted by perceived consequences, and negatively predicted by perceived personal control. In contrast, diabetes integration was positively predicted by perceived personal control and negatively predicted by perceived consequences.

Table 5 provides an overview of each indirect path, its point estimate, standard error, and 95% confidence intervals. As shown in Table 5, all but one indirect paths between Neuroticism, Agreeableness, and illness coping through perceived consequences and perceived personal control were significant. Hence, our findings partially support the hypothesis displayed in Figure 1 Panel c, in that illness perceptions partially mediated the associations between Neuroticism, Agreeableness, and illness coping.

DISCUSSION

Personality traits have been related to the ways in which young people deal with the challenges accompanying a chronic illness (Rassart et al., 2013; Van de Ven & Engels, 2011). The present study adds to this body of knowledge by demonstrating that some of the Big Five personality traits functioned as important predictors of illness adaptation in young people with Type 1 diabetes. Further, the present findings also indicated that illness perceptions and coping functioned as potential intervening mechanisms on the pathway to illness adaptation.

Before discussing these findings in more detail, readers should note that all results were obtained after controlling for the effects of sex, age, and illness duration. Women generally perceived less personal control in dealing with their diabetes, used more passive ways of coping, and showed higher levels of diabetes-related problems. Indeed, female patients have typically been found to cope less well with their illness, as evidenced by higher rates of depression, eating disorders, and diabetes-related worries (Daneman et al., 2002; Enzlin, Mathieu, & Demyttenaere, 2002; Undén et al., 2008). Furthermore, older patients generally showed lower levels of avoidant coping, which suggests that patients increasingly learn to deal with diabetes-related challenges as they grow older. However, somewhat surprisingly, increasing illness

duration was associated with higher levels of avoidant and passive coping. Relatedly, Austin and colleagues (2011) have demonstrated that longer diabetes duration was related to poorer dietary self-care. With increasing illness duration, patients are expected to assume more responsibility for their own self-care and, hence, they might experience less support from parents and healthcare professionals, potentially resulting in poorer adherence (Austin, Senécal, Guay, & Nouwen, 2011). More research is needed to unravel the effects of age and illness duration on illness-related processes.

Personality and Illness Adaptation: The Role of Illness Perceptions and Coping

In line with the five-factor theory of personality (McCrae & Costa, 1999), Big Five personality traits were found to predict patients' illness adaptation above and beyond the effects of sex, age, and illness duration. First, patients high in Agreeableness were found to report fewer diabetes-related problems. This association was fully explained by illness coping. That is, patients high in Agreeableness generally showed higher levels of diabetes integration which, in turn, was related to favorable illness adaptation. This finding is in line with a recent study in young people with asthma, in which agreeable patients were found to hide their illness less for others, pointing to greater feelings of acceptance regarding their illness (Van de Ven & Engels, 2011). Furthermore, the present findings showed perceived consequences to fully account for the association between Agreeableness and diabetes integration. Agreeable patients generally reported fewer consequences of their illness on their daily lives, which might have helped them in integrating the illness in their sense of self. Agreeable individuals have indeed been found to have a more optimistic outlook on life, to use more positive reappraisal in dealing with stressors, and to pay less attention to physical discomfort, potentially resulting in less perceived consequences (Van de Ven & Engels, 2011; Van Straten, Cuijpers, Van Zuuren, Smits, & Donker, 2007).

Second, lower levels of Conscientiousness were found to predict poorer illness adaptation. This association was fully mediated by illness coping, that is, patients low in Conscientiousness tended to use more avoidant and passive ways of coping which, in turn, were related to more diabetes-related problems. A recent study demonstrated that patients low in Conscientiousness tend to show poor adherence to treatment guidelines (Skinner et al., 2002; Wheeler, Wagaman, & McCord, 2012), which is in line with the higher use of maladaptive coping strategies observed in the present study. The associations between Conscientiousness, avoidant coping, and passive resignation could not be accounted for by perceived consequences or by perceived personal control. Other illness perceptions, such as perceived timeline (i.e., ideas about how the illness will evolve over time), might be involved (Lawson et al., 2010). Alternatively, the association between Conscientiousness and illness coping might be more direct in nature. Indeed, individuals low in Conscientiousness are generally described as carefree, irresponsible, and impulsive and all of these characteristics may directly underlie these maladaptive ways of coping.

Third, high levels of Neuroticism were found to put patients at greater risk for poor illness adaptation. This association was partially mediated by illness coping, that is, patients high in Neuroticism showed more avoidant coping and passive resignation, and less diabetes integration. Previous research also found patients high in Neuroticism to use more maladaptive coping strategies such as rumination, which can be subsumed under the more general heading of passive resignation (Van de Ven & Engels, 2011). Perceived consequences and perceived personal control were found to partially mediate the associations between Neuroticism and illness coping. More specifically, patients high in Neuroticism tended to report more consequences of the illness on their daily lives and to experience less personal control. More perceived consequences and less personal control, in turn, were related to the use of maladaptive coping strategies and a lack of diabetes integration. Individuals high in Neuroticism have indeed

been found to perceive and report more physical and psychosocial difficulties (Deary, Clyde, & Frier, 1997; Jylhä & Isometsä, 2006; Van De Ven & Engels, 2011). Furthermore, these individuals tend to lack confidence and have a rather negative, pessimistic outlook on life (Muris, Roelofs, Rassin, Franken, & Mayer, 2005), which potentially results in less perceived control.

Although the relationship between Neuroticism and illness adaptation could be partially explained by illness coping, Neuroticism continued to predict these problems directly. Other mediators might be involved in this association, such as the availability of a social support system. Because individuals high in Neuroticism are more likely to be moody, anxious, and easily frustrated (Caspi et al., 2005), others might be less willing to support them, thereby negatively affecting their illness adaptation.

Finally, Openness and Extraversion did not significantly predict any of the diabetes-related problems. The latter finding came rather unexpectedly, as previous research in other clinical populations found Extraversion to be a unique predictor of patients' illness adaptation (Rassart et al., 2013; Van de Ven & Engels, 2012). Having a strong social orientation – one of the key facets of Extraversion (Caspi et al., 2005) – might be less adaptive for young people with diabetes, as it might interfere with patients' treatment responsibilities. Previous research has indeed shown that peers can detract patients from self-care behaviors (Helgeson, Siminerio, Escobar, & Becker, 2009). Hence, the finding that Extraversion was not related to patients' illness adaptation may reflect the difficult balance young people face between social or peer integration on the one hand and treatment adherence on the other hand. Future research on this topic would benefit from a more in-depth assessment of the Big Five personality traits, using personality facets (i.e., more specific and narrow personality characteristics) in addition to the five broad personality domains.

Theoretical Implications

First, important associations were found between patients' personality traits and illness adaptation, which is in line with the five-factor theory of personality (McCrae & Costa, 1999). These findings demonstrate that the Big Five is a valuable framework for examining linkages between personality and illness adaptation (Rassart, Luyckx, Klimstra, & Moons, 2012). Hence, future research in individuals with chronic illness should not focus exclusively on isolated personality traits such as Neuroticism or Conscientiousness, as the present study has shown that also Agreeableness can be considered an important predictor of illness adaptation (Rassart et al., 2013).

Second, our findings partially support the common sense model forwarded by Leventhal and colleagues (1984). More specifically, illness perceptions were found to predict the ways in which patients coped with their illness. These coping strategies, in turn, predicted patients' illness adaptation. However, it should be noted that patients' illness perceptions not only influenced the ways in which patients coped with their illness; they were also found to influence patients' illness adaptation directly. That is, perceptions of high consequences were associated with more diabetes-related problems. This finding is in line with previous research demonstrating the importance of patients' illness perceptions for both subjective and objective indicators of illness adaptation (Hagger & Orbell, 2003).

Third, the present study provides support for the intervening role of illness perceptions and coping in the associations between the Big Five and illness adaptation, thereby integrating the five-factor theory of personality (McCrae & Costa, 1999) and the common sense model forwarded by Leventhal and colleagues (1984). However, in the present study, only two out of five personality traits uniquely predicted patients' illness perceptions. These results differ from the study by Lawson and colleagues (2010), in which all of the Big Five traits were found to predict patients' illness perceptions. These contrasting findings might be partially explained by the rather narrow approach to illness perceptions that was adopted in the present study, as we

focused exclusively on perceived consequences and perceived personal control. The study by Lawson and colleagues (2010) has indeed demonstrated the importance of other illness perceptions such as perceived treatment control (i.e., ideas about whether the illness can be controlled through treatment) and illness coherence (i.e., ideas about whether the illness makes sense to the patient) in the relationship between the Big Five and coping. Future research on this topic should therefore include a broader array of illness perceptions.

Furthermore, no evidence was found for the mediating role of perceived consequences and personal control in the relationship between Conscientiousness and illness coping. Hence, to gain a clearer understanding of the relationship between personality traits and coping strategies, future research needs to explore other intervening mechanisms as well. For instance, many models within psychosomatics assume that certain personality traits may promote the experience of stress which, in turn, can affect health and adaptation both directly and indirectly (e.g., through coping) (Pettit, Grover, & Lewinsohn, 2007). As such, it might be important to explore the role of stress in the relationship between personality traits and illness coping in individuals with diabetes. In conclusion, the present study adds to the current literature by developing an encompassing model of the link between personality and illness adaption in young people with Type 1 diabetes which can guide health care professionals in their clinical work with these individuals.

Clinical Implications

Provided that these findings are replicated in future research, they can have important clinical implications. First, the present study identified illness perceptions and illness coping as potential intervening mechanisms in the associations between Big Five personality traits and illness adaptation. Hence, intervention programs targeting patients' illness perceptions and coping strategies should be encouraged. Indeed, previous research has shown that intervention programs focusing on maladaptive illness perceptions and coping strategies in adults with

poorly controlled Type 1 and Type 2 diabetes can improve patients' metabolic control and psychosocial functioning (Keogh et al., 2011; Snoek et al., 2001).

Second, the present study found personality traits to predict the ways in which patients think about and cope with their illness. A first substantial step would be to tailor intervention programs aimed at modifying patients' illness perceptions and coping strategies to fit the needs of the individual patient. Patients' personality may be assessed by a brief self-report questionnaire such as the one described earlier (i.e., the Quick Big Five; Vermulst & Gerris, 2005) in which patients are asked to rate themselves on a series of adjectives. Next, health care professionals can compute Big Five scores and compare these to the scores of available norm groups or, alternatively, look in a more qualitative manner at the different item responses of the particular patient. Assessing the personality of patients provides health professionals with a context for understanding the problems that patients report, and helps them to select appropriate interventions and to frame these interventions to the patient (Hall, 2011; Matthews, Saklofske, Costa, Deary, & Zeidner, 1998). For instance, the present findings show that patients low in Agreeableness generally perceive more consequences of their illness on their daily life and are less accepting of their illness. Hence, health care professionals working with these individuals should particularly focus on developing a more accepting attitude towards the presence of diabetes, making the illness feel less like a burden. For patients high in Neuroticism, a stronger focus is needed on enhancing patients' feelings of personal control and teaching them how to cope with their illness in a more active manner.

A next step would be to improve patients' illness adaptation directly through the modification of patients' personality traits. Although personality traits have generally been conceptualized as stable and relatively unchangeable patterns of thoughts, feelings, and actions, emerging research has demonstrated that personality traits can be changed through interventions (e.g., De Fruyt, Van Leeuwen, Bagby, Rolland, & Rouillon, 2006; Tang et al.,

2009). According to a recently developed framework (Chapman, Hampson, & Clarkin, in press; Magidson, Lejuez, & Roberts, in press), personality traits can be modified by targeting the core behaviors that underlie these traits (e.g., stimulating goal setting and self-discipline in individuals low in Conscientiousness). Through repeated practise of new target behaviors, behavioral changes may become more automatic and ingrained over time, ultimately manifesting themselves in trait-level changes. These trait-level changes, in turn, may affect patients' illness perceptions, coping behaviors, and adaptation. However, before implementing such interventions in clinical practice, more research is required on the appropriate dose (i.e., number of sessions) and format (i.e. group vs. individual) needed to change patients' personality traits (Magidson et al., in press).

Limitations and Suggestions for Future Research

The present study has some limitations. First, although the Big Five has proven to be a valuable framework in examining linkages between personality and health (Rassart et al., 2012; Van de Ven & Engels, 2011), it represents only one of several possible frameworks. According to the model by McAdams and Olson (2010), personality has to be assessed at different levels of analysis. As agents of their own development, people's thoughts, feelings, and actions are not only determined by relatively enduring personality dispositions such as the Big Five; they are also shaped by motivated identity choices, plans, and goals (Rassart et al., 2012). Consequently, future research on the relationship between personality and illness adaptation should also use frameworks beyond the Big Five.

Second, because of our cross-sectional design, we were unable to determine the direction of effects between the different study variables. For instance, it can be expected that patients' illness perceptions not only shape their coping behaviors. The success of these coping behaviors in attaining desired outcomes can, in turn, shape patients' illness perceptions (Hagger & Orbell, 2003). The model tested should therefore be replicated using a longitudinal design.

Third, although a substantial number of path coefficients was moderate in size (i.e., >.30; Cohen, 1988), most effects could be considered small and, hence, findings should be interpreted with caution. Similar concerns could be raised regarding some of the correlations. It should be noted, however, that these coefficients were obtained after controlling for the effects of sex, age, and illness duration. Further, relatively modest coefficients could be expected given that the variables under study are potentially determined by additional variables not assessed in the present study.

Fourth, data were gathered through self-report questionnaires only. Although self-report is the most valid approach to assess variables such as personality and illness perceptions, future research would benefit from a multi-informant design. Relatedly, future research should also include objective indicators of patients' illness functioning such as levels of glycosylated hemoglobin (HbA_{1C}). Fifth, because of the relatively low response rate, the present findings should be generalized with caution. Low participation rates may introduce sample bias because individuals experiencing serious problems with their diabetes could be underrepresented. Sixth, in line with previous research (Luyckx et al., 2010; Turan, Osar, Turan, Ilkova, & Damci, 2003), the internal consistencies of some of the coping scales (and the tackling spirit scale in particular) were quite low. Future research should develop and use more reliable measures of illness coping.

Despite these limitations, the present study generated important information on the potential intervening roles of illness perceptions and coping in the relationship between personality and illness adaptation in a large sample of individuals with Type 1 diabetes. We therefore hope that our findings can guide health care workers in dealing with illness adaptation problems in this particular population.

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Table 1

Univariate ANOVAs, Means, and F-Values for Sex

Variable	Total Sample	Sex		*F*-value (η^2)
		Men	Women	
Big Five traits				
1. Extraversion	4.62 (1.44)	4.60 (1.41)	4.62 (1.47)	0.02 (.00)
2. Agreeableness	5.72 (0.70)	5.71 (0.69)	5.74 (0.71)	0.26 (.00)
3. Conscientiousness	4.55 (1.32)	4.40 (1.33)	4.72 (1.28)	5.23* (.01)
4. Neuroticism	4.11 (1.22)	3.80 (1.21)	4.47 (1.12)	29.58*** (.08)
5. Openness	4.67 (1.04)	4.80 (0.95)	4.50 (1.14)	7.62** (.02)
Illness perceptions				
6. Consequences	3.02 (0.69)	2.97 (0.69)	3.09 (0.69)	3.20 (.01)
7. Personal control	4.11 (0.59)	4.21 (0.58)	4.00 (0.58)	11.75** (.03)
Illness coping				
8. Avoidant coping	2.89 (1.02)	2.83 (1.03)	2.97 (1.01)	1.64 (.00)
9. Passive resignation	2.30 (0.94)	2.16 (0.91)	2.47 (0.95)	10.52** (.03)
10. Diabetes integration	2.93 (0.88)	3.00 (0.90)	2.84 (0.86)	2.73 (.01)
Illness adaptation				
11. Diabetes-related problems	28.84 (19.78)	25.14 (19.16)	33.45 (19.68)	16.56*** (.04)

Note. Standard deviations in parentheses. Big Five traits can range from 1 to 7; illness perceptions and illness coping can range from 1 to 5. Illness adaptation ranges from 0 to 100.

*$p < .05$. ** $p < .01$. *** $p < .001$.

Table 2

Correlations Among Study Variables

Variable	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. Extraversion	.30***	-.13*	-.35***	.29***	-.15**	.15**	-.05	-.10*	.14**	-.10	.05	.00
2. Agreeableness	---	.13*	-.15**	.26***	-.28***	.14**	-.13*	-.16**	.25***	-.21***	-.01	.01
3. Conscientiousness		---	.09	.10	-.01	.03	-.23***	-.17***	.00	-.05	.21***	-.09
4. Neuroticism			---	-.14**	.26***	-.28***	.21***	.34***	-.27***	.37***	-.08	.02
5. Openness				---	-.11*	.17**	-.05	-.11	.14*	-.10*	.11*	.00
6. Consequences					---	-.24***	.34***	.46***	-.53***	.54***	.08	.09
7. Personal control						---	-.23***	-.54***	.32***	-.40***	.07	-.09
8. Avoidant coping							---	.53***	-.47***	.50***	-.15**	.10*
9. Passive resignation								---	-.56***	.67***	-.08	.13*
10. Diabetes integration									---	-.64***	-.01	.05
11. Diabetes-related problems										---	.07	.00
12. Age											---	.09
13. Illness duration												---

*$p < .05$. ** $p < .01$. *** $p < .001$

Table 3

An Overview of the Non-Significant Paths for Model 3 (Relating the Big Five to Illness Adaptation Through Illness Coping)

Independent Variable	**Dependent Variable**	**β**	***p***
Extraversion	Avoidant coping	.013	.815
Extraversion	Passive resignation	.019	.748
Extraversion	Diabetes integration	-.015	.807
Extraversion	Diabetes-related problems	.044	.233
Agreeableness	Avoidant coping	-.083	.149
Agreeableness	Passive resignation	-.097	.053
Agreeableness	Diabetes-related problems	-.049	.179
Conscientiousness	Diabetes integration	.010	.860
Conscientiousness	Diabetes-related problems	.002	.961
Openness	Avoidant coping	.035	.541
Openness	Passive resignation	-.013	.792
Openness	Diabetes integration	.055	.329
Openness	Diabetes-related problems	.005	.881

Note. β = standardized path coefficient.

Table 4

An Overview of the Non-Significant Paths for Model 6 (Relating the Big Five to Illness Coping Through Illness perceptions)

Independent Variable	**Dependent Variable**	**β**	***p***
Extraversion	Personal control	.031	.634
Extraversion	Consequences	-.007	.911
Extraversion	Avoidant coping	.019	.715
Extraversion	Passive resignation	.034	.456
Extraversion	Diabetes integration	-.024	.639
Extraversion	Diabetes-related problems	.046	.204
Agreeableness	Personal control	.073	.200
Agreeableness	Avoidant coping	-.010	.916
Agreeableness	Passive resignation	.010	.836
Agreeableness	Diabetes integration	.078	.120
Agreeableness	Diabetes-related problems	-.026	.472
Conscientiousness	Personal control	.037	.483
Conscientiousness	Consequences	-.019	.738
Conscientiousness	Diabetes integration	-.010	.905
Conscientiousness	Diabetes-related problems	-.003	.944
Openness	Personal control	.085	.120
Openness	Consequences	-.020	.702
Openness	Avoidant coping	.050	.366
Openness	Passive resignation	.027	.534
Openness	Diabetes integration	.030	.555
Openness	Diabetes-related problems	.005	.875

Note. β = standardized path coefficient.

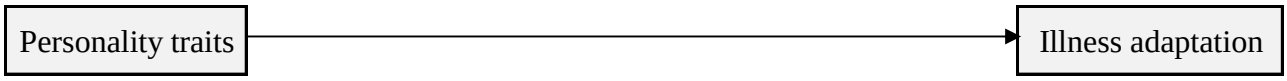
Table 5

Overview of Indirect Effects for the Partial Mediation Model Relating the Big Five to Illness Adaptation Through Illness Coping (Model 3) and the Partial Mediation Model Relating the Big Five to Illness Coping Through Illness perceptions (Model 6).

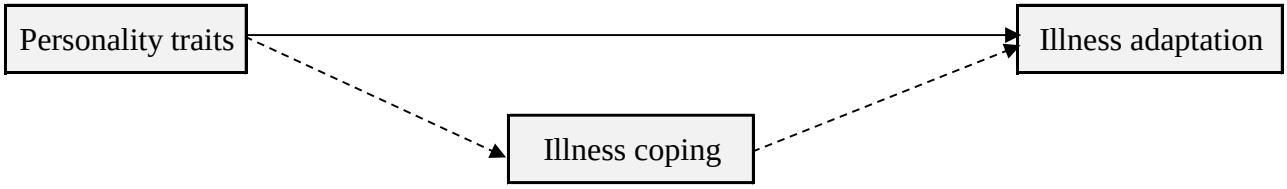
Indirect associations			Point estimate	SE	95% confidence intervals	
IV	**M**	**DV**			**Lower**	**Upper**
Model 3						
Agreeableness	Diabetes integration	Diabetes-related problems	-.072**	0.023	-.139	-.019
Conscientiousness	Avoidant coping	Diabetes-related problems	-.018*	0.007	-.044	-.004
Conscientiousness	Passive resignation	Diabetes-related problems	-.041**	0.014	-.080	-.009
Neuroticism	Avoidant coping	Diabetes-related problems	.019*	0.008	.004	.049
Neuroticism	Passive resignation	Diabetes-related problems	.075***	0.016	.039	.125
Neuroticism	Diabetes integration	Diabetes-related problems	.049***	0.014	.017	.090
Model 6						
Agreeableness	Consequences	Avoidant coping	-.100***	0.028	-.190	-.039
Agreeableness	Consequences	Passive resignation	-.104***	0.028	-.191	-.044
Agreeableness	Consequences	Diabetes integration	.137***	0.034	.058	.236
Neuroticism	Consequences	Avoidant coping	.051**	0.016	.016	.103
Neuroticism	Consequences	Passive resignation	.053***	0.016	.019	.099
Neuroticism	Consequences	Diabetes integration	-.070***	0.019	-.127	-.025
Neuroticism	Control	Avoidant coping	.022	0.013	-.002	.065
Neuroticism	Control	Passive resignation	.068***	0.020	.023	.127
Neuroticism	Control	Diabetes integration	-.029**	0.011	-.068	-.008

Note. IV = independent variable; M = mediator; DV = dependent variable. 5,000 bootstrap samples. *$p < .05$. ** $p < .01$. *** $p < .001$

Panel a



Panel b



Panel c

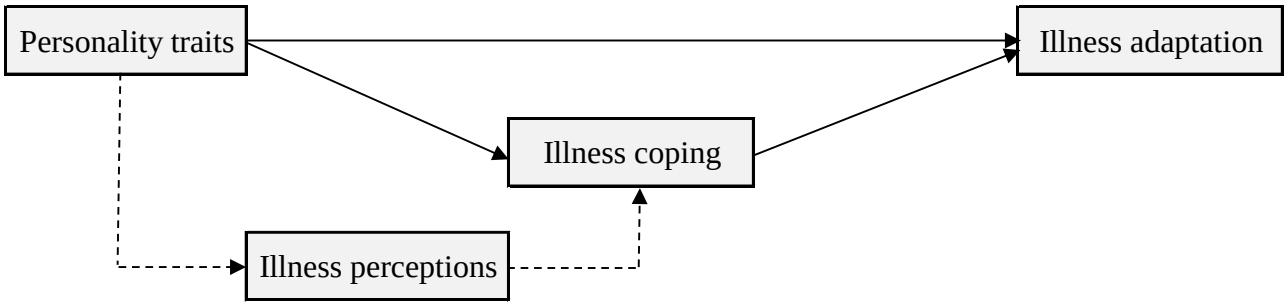


Figure 1. Graphical representation of research objective 1 (*Panel a*), research objective 2 (*Panel b*), and research objective 3 (*Panel c*).

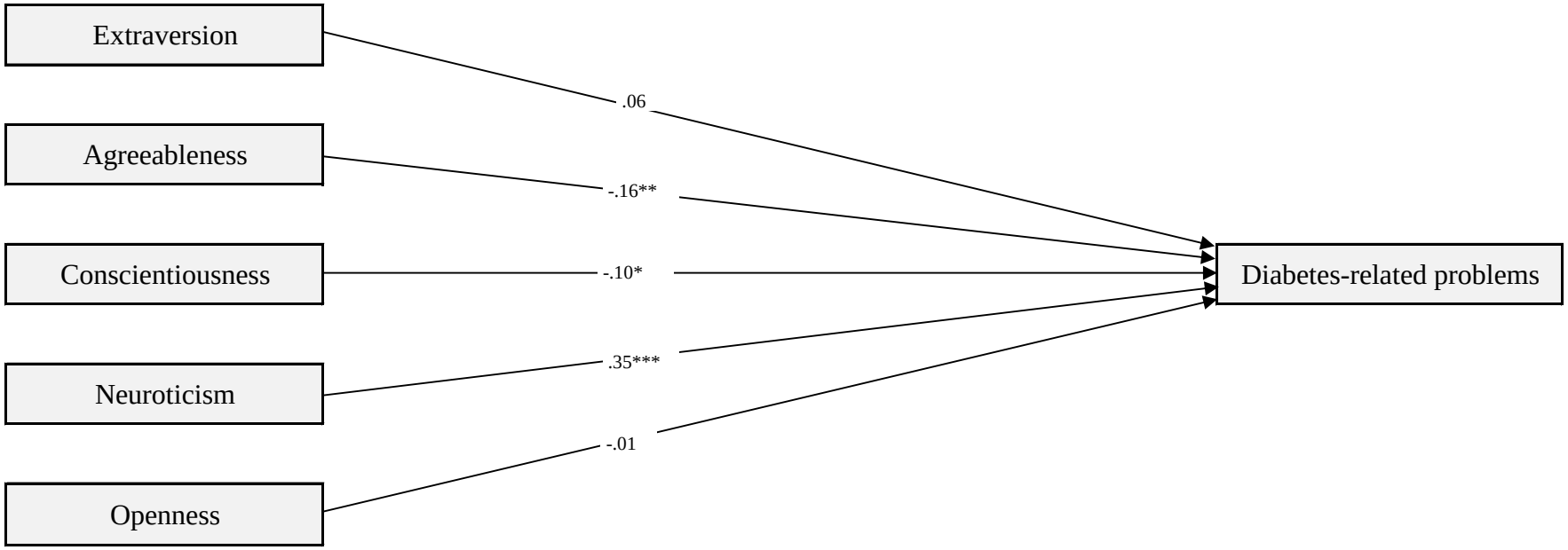


Figure 2 . Direct effects model relating the Big Five to illness adaptation (Model 1). All paths from sex, age, and illness duration are not presented for reasons of clarity. All path coefficients are standardized. *$p < .05$. **$p < .01$. ***$p < .001$.

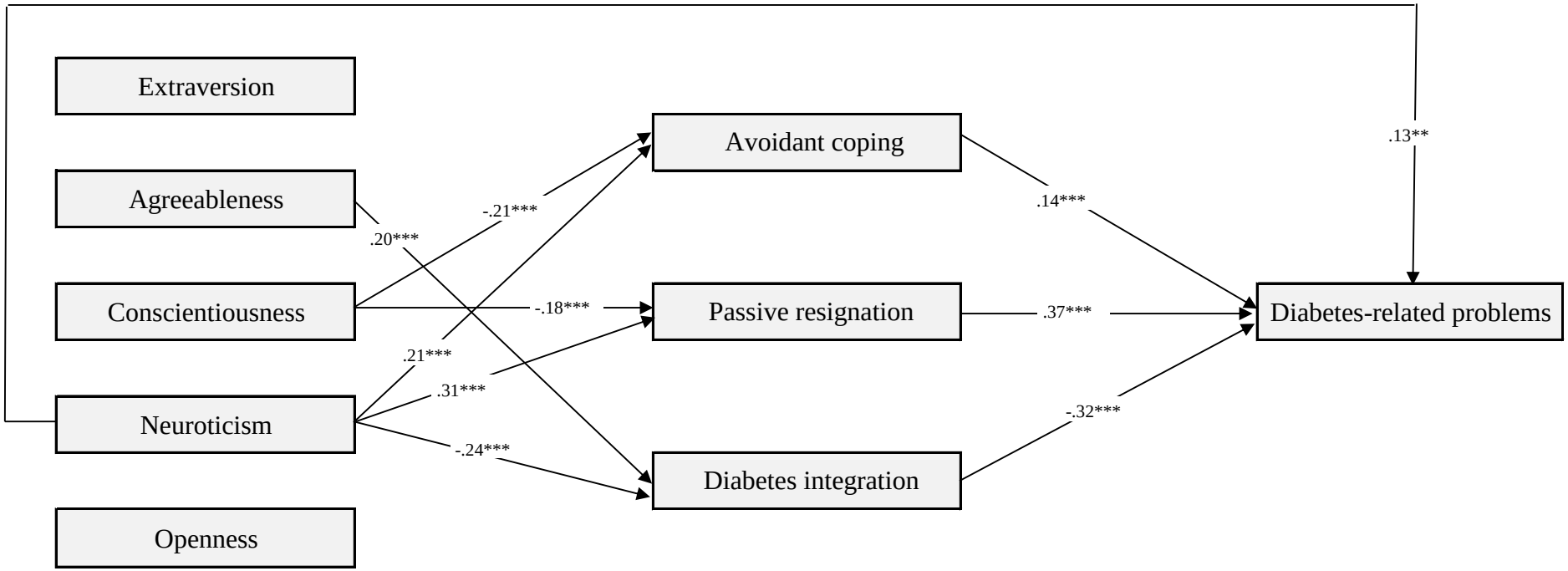


Figure 3 . Partial mediation model relating the Big Five to illness adaptation through illness coping (Model 3). All paths from sex, age, and illness duration are not presented for reasons of clarity. All path coefficients are standardized. *$p < .05$. **$p < .01$. ***$p < .001$.

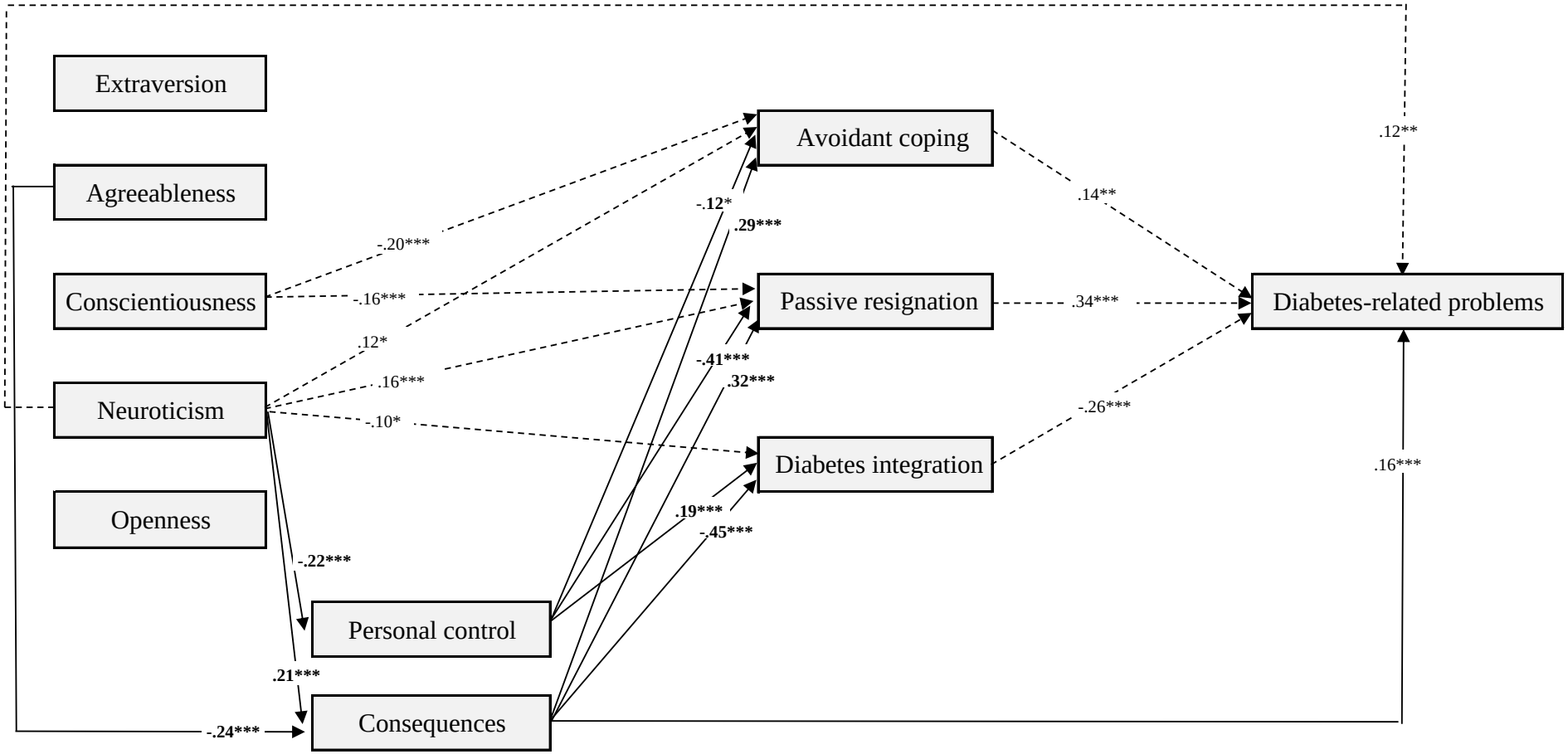


Figure 4. Partial mediation model relating the Big Five to illness coping through illness perceptions (Model 6). Paths from sex, age, and illness duration are not presented for reasons of clarity. All path coefficients are standardized. Paths already shown in Figure 3 are displayed as dotted lines. *$p < .05$. **$p < .01$. ***$p < .001$.